Yao syndrome

Yao syndrome (formerly called *NOD2*-associated autoinflammatory disease) is a disorder involving episodes of fever and abnormal inflammation affecting many parts of the body, particularly the skin, joints, and gastrointestinal system. Inflammation is a normal immune system response to injury and foreign invaders (such as bacteria). In people with Yao syndrome, part of the immune system called the innate immune response is turned on (activated) abnormally, which causes fevers and inflammation-related damage to tissues and organs. Based on this process, Yao syndrome is classified as an autoinflammatory disease. Autoinflammatory diseases are distinct from autoimmune diseases; these two groups of diseases involve abnormalities in different parts of the immune system.

The episodes of fever and inflammation associated with Yao syndrome can last for several days and occur weeks to months apart. During these episodes, most affected individuals develop reddened, inflamed areas on the skin called erythematous patches or plaques. This reddening occurs most commonly on the face, chest, and back but can also affect the arms and legs. Episodes of joint pain and inflammation similar to arthritis are common, particularly in the legs, as is swelling of the ankles and feet. Inflammation also affects the gastrointestinal system, causing attacks of abdominal pain, bloating, and cramping with diarrhea in more than half of affected individuals. Dry eyes and dry mouth (described as "sicca-like" symptoms, which refers to dryness) are reported in about half of people with this disease. Other potential signs and symptoms of Yao syndrome include mouth sores, chest pain, and enlargement of various glands.

Yao syndrome is usually diagnosed in adulthood. It is a long-lasting (chronic) disease, and episodes can recur for many years.

Frequency

Yao syndrome has an estimated prevalence of 1 in 10,000 to 1 in 100,000 people worldwide. Studies suggest that it is among the most common systemic (affecting the whole body) autoinflammatory diseases in adults. For unknown reasons, Yao syndrome appears to affect women more frequently than men.

Causes

The causes of Yao syndrome are complex. This condition likely results from a combination of genetic and environmental factors, many of which are unknown.

Certain variations in the *NOD2* gene increase the risk of developing Yao syndrome. The NOD2 protein plays several essential roles in the immune system's response to foreign invaders, including inflammatory reactions. Studies suggest that most people with Yao syndrome have at least one variation in the *NOD2* gene, and some have two

or more. It is unclear what effect these variations have on the amount or function of the NOD2 protein, or how they might contribute to abnormal inflammation in people with Yao syndrome. Researchers suspect that environmental factors such as infections may also play a role in triggering the disease in people with genetic variants that increase their risk.

Inheritance Pattern

Because Yao syndrome appears to be a complex disease without a single genetic cause, it does not have a straightforward pattern of inheritance. A small percentage of affected individuals have a family history of the disease. Many people who have one or more of the *NOD2* gene variants associated with Yao syndrome never develop the disease.

Other Names for This Condition

- NAID
- NOD2-associated AID
- NOD2-associated autoinflammatory disease
- YAOS

Diagnosis & Management

Genetic Testing Information

- What is genetic testing?
  /primer/testing/genetictesting
- Genetic Testing Registry: Yao syndrome
  https://www.ncbi.nlm.nih.gov/gtr/conditions/C4310620/

Other Diagnosis and Management Resources

- Estephan M, Yao Q, Springer J. Case of NOD2-Associated Autoinflammatory Disease Successfully Treated With Sulfasalazine. J Clin Rheumatol. 2017 Jan; 23(1):58-59. doi: 10.1097/RHU.0000000000000468.
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  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/27984003

Additional Information & Resources

Health Information from MedlinePlus

- Health Topic: Fever
  https://medlineplus.gov/fever.html
- Health Topic: Immune System and Disorders
  https://medlineplus.gov/immunesystemanddisorders.html

Additional NIH Resources

- National Institute of Arthritis and Musculoskeletal and Skin Diseases: Autoinflammatory Diseases
  https://www.niams.nih.gov/health-topics/autoinflammatory-diseases

Educational Resources

- MalaCards: yao syndrome
  https://www.malacards.org/card/yao_syndrome

Patient Support and Advocacy Resources

- Autoinflammatory Alliance
  http://www.nomidalliance.org/

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28Yao+syndrome%5BTIAB%5D%29+OR+%28%28NOD2%5BTI%5D%29+AND+%28autoinflammatory%5BTI%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D

Catalog of Genes and Diseases from OMIM

- YAO SYNDROME
  http://omim.org/entry/617321

Medical Genetics Database from MedGen

- Yao syndrome
  https://www.ncbi.nlm.nih.gov/medgen/934587

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